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Production of Cocoyam, Cassava and Wheat Flour Composite Rock Cake

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Abstract: The proximate and sensory analysis of the cassava-cocoyam supplemented wheat flour rock cake has been made. This was done to investigate the nutritional value and the general acceptability of the cassava flour and cocoyam flour supplemented rock cake. The proximate analysis indicate that the moisture content, ash and the carbohydrate increase with increasing cassava and cocoyam flour concentration. Generally the ash content of composite rock cakes increases as the level of supplementation increases implying that the inorganic nutrients in the composite rock cake is richer than that of wheat rock cake. It is observed from the organoleptic analysis that generally, whole wheat rock cake and cassava and cocoyam supplemented rock cake with cassava and cocoyam flour up to 30% is preferred to rock cake with cassava and cocoyam flour beyond 30%. Thus cassava and cocoyam flour can be used to substitute for wheat flour up to about 30%.

Key words: Cocoyam flour, cassava flour, proximate analysis, sensory evaluation

INTRODUCTION

Over the years, the demand for pastry products in Ghana has been on the increase. Pastries such as rock cakes, cakes and turnovers are sold at every corner of the streets of the urban centres of Ghana as snacks. In as much as the demand for pastry products increase, the cost of the products also becomes very expensive (Dotsey, 2009). This high cost is due to the fact that, urbanization in Ghana has increased the consumption of processed food and bakery products as well as increased the demand for imported products. To reduce imports and to save foreign exchange, it has been proposed that wheat be substituted with alternative local products such as cassava, cocoyam, rice, sweet potato and maize flours in the production of cakes.

Two types of crops are known by the name *cocoyam*, and are both herbaceous plants. The most common one found on the Ghanaian market is formally known as new cocoyam (*Xanthosoma sagittifolium*) and its leaves are used as vegetables (kontomire). The second type is known as old cocoyam (*Colocasia esculenta*) or taro; it grows in marshy areas and unlike the new cocoyam, its leaves are not eaten (Dotsey, 2009).

Cocoyam (*Xanthosoma sagittifolium*) contribute significant portion of the carbohydrate content of the diet in many regions in developing countries and provide edible starchy storage corms or cormels. Although they are less important than other tropical roots such as yam, cassava and sweet potato, they are still a major staple in some parts of the tropics and sub-tropics (Opara, 2002; Ojinaka *et al*., 2009).

The high content of calcium oxalate crystals 780 mg per 100 g in some species of cocoyam, has been implicated in the acridity or irritation caused by cocoyam. Oxalates tend to precipitate calcium and make it unavailable for use by the body. The acridity of high oxalate cultivars of cocoyam can be reduced by peeling, grating, soaking and fermenting during processing (Food-info.net, 2010). Cocoyam is used essentially the same way as yam, although it is not considered as prestigious as yam. Its flour has the added advantage that, it is highly digestible and so is used for invalids and as an ingredient in baby foods.

Cassava (*Manihot esculenta*) is one of the most important crops in Ghana. In Africa, most cassava that is produced is used for human food though in recent times, the industrial utilization is on the ascendency. It is estimated that cassava provided about 40% of the calories consumed in Africa (UNICEF, 1991). In Ghana, the crop has several uses such as in:

Ampesi = Boiled cassava tubers normally eaten with stew
Akple = Prepared from a mixture of cassava and corn dough
Fufu = Boiled and pounded cassava eaten with soup
Yakayake = Steamed cassava dough
Kokonte = Dried unfermented cassava chips, milled into flour and made into a thick paste and accompanied with soup, just to mention a few (Dotsey, 2009)

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Recently, varied percentages of wheat flour to cassava flour have been used to produce rock cake and pastry products successfully (UNICEF, 1991). The use of locally produced cassava flour to replace wheat flour as a source of carbohydrate, would reduce the cost of production and save on foreign exchange. Cassava does not contain any gluten and so if used to replace wheat flour 100%, the quality of the product will be different. A suitable ratio for replacing wheat flour that will appeal to consumers will depend on the kind of food. However, the properties of cassava flour are similar to those of wheat flour and therefore can partially substitute for wheat flour in many wheat-based products.

According to Kent and Evers (1994) flours milled from other crops such as maize, millet, sorghum, cassava, potatoes and rice has been added to wheat flour to extend the use of the local crops to reduce the cost of wheat importation. This is practiced mostly in tropical countries where the soil and climate are not favourable for commercial large scale production of wheat. Satisfactory rock cake has been made from such composite flour through a blend of wheat flour with other cereals and root crops. In this work, composite rock cake made from wheat flour, cassava flour and cocoyam flour is studied for its nutritional qualities. The analysis of its acceptance by consumers is also made.

MATERIALS AND METHODS

Cocoyam, cassava and wheat flour were both purchased from the Kotokuraba market in Cape Coast, Central region of Ghana. They were sent to the laboratory of the Food Research Institute, Council for Scientific and Industrial Research, for processing. The cassava and cocoyam were processed into flour.

Preparation of cassava and cocoyam flour: The fresh roots of cassava was washed and peeled and the peeled roots were also washed. It was then cut into 7-8 cm thick discs. It was weighed, arranged randomly on the drying trays in single layers and placed in the drying machine (Hot Air Oven Dryer) at the temperature of 65°C for 9-10 h. After drying, the moisture content of the cassava should be less than 8%. The next day, the cassava was heated for 1 h to remove acquired moisture and milled using attrition milling machine into flour and sieved through an 80 mesh sieve.

The cocoyam was washed, peeled, washed again. It was then cut into 3-4 cm thick discs. They were weighed and arranged randomly on the drying trays in single layers and placed in the drying machine (Hot Air Oven Dryer) at the temperature of 65°C for 9 h. The next day, the cocoyam was heated for 1 h because it was a little moist. After that it was milled using a double disc attrition milling machine into flour and sieved.

Seven composite samples were prepared by mixing cocoyam, cassava and wheat flour in the proportions indicated in Table 1, using a Kenwood food mixer KN 201, England. The mixing was done to ensure a homogeneous mixture of the samples.

All the seven samples were baked using the standard method (Ceserani and Kinton, 2008) (Fig. 3). All dry ingredients were mixed together in a bowl until a sandy

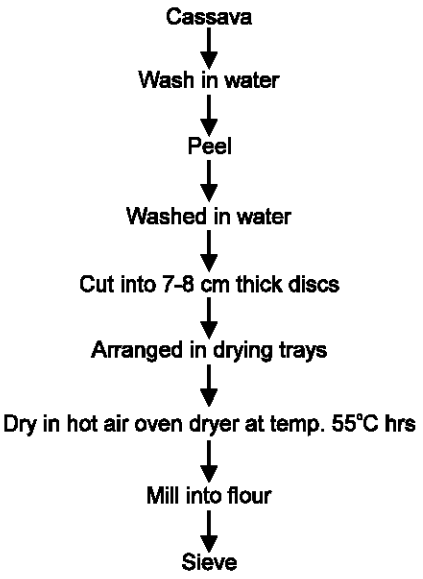

Fig. 1: Flow chart for preparation of cassava flour

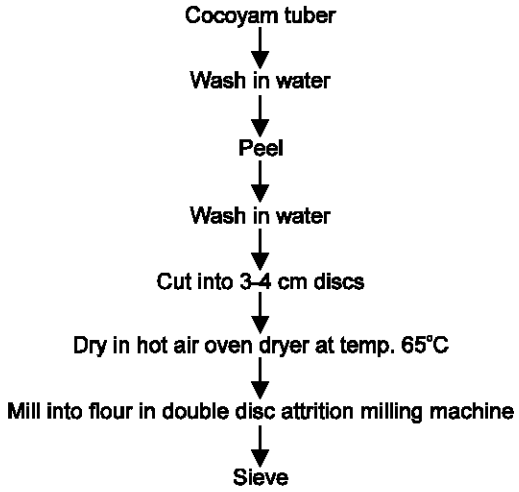

Fig. 2: Flow chart for preparation of cocoyam flour

Table 1: Sample formulation

Samples	Wheat flour (%)	Cassava flour (%)	Cocoyam flour (%)
A	100	0	0
B	90	5	5
C	80	10	10
D	70	15	15
E	60	20	20
F	50	25	25
G	40	30	30

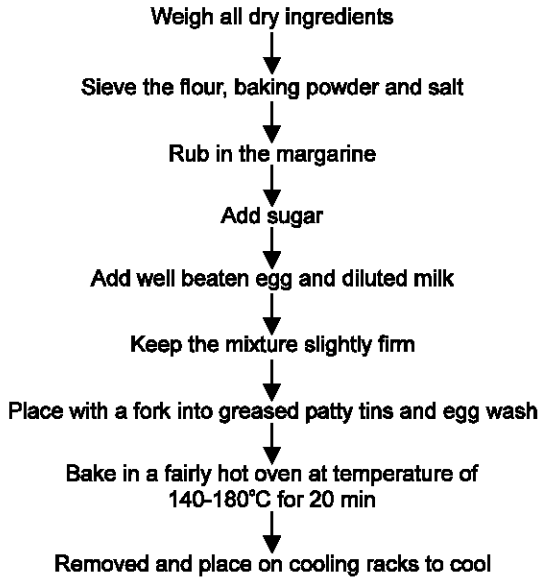

Fig. 3: Flow chart for preparation of rock cakes

texture was achieved. The diluted milk, beaten egg and flavouring were added and mixed thoroughly until a slightly firm mixture was achieved. The mixture were placed into greased patty tins with a fork to achieve a rough surface, it was egg washed and placed in a fairly hot oven at 140-180°C for 20 min. It was removed and placed on a cooling rack to cool.

The sensory attributes including colour, taste, texture, flavour, aroma, appearance and general acceptance were evaluated by untrained 30 member panel, using a 5-point Hedonic scale according to Watts *et al.* (1989) with a scale ranging from 1 to 5 with 1 representing the least score (dislike extremely) and 5 the highest score (like extremely). Analysis of Variance (ANOVA) was performed on the data gathered to determine differences, while the least significant test according to Ihekoronye and Ngoddy (1985) was used to detect differences among the means.

Proximate analysis of samples was determined according to AOAC (1990; 2000). The samples were analyzed for moisture content, ash, protein, fat, carbohydrate (by difference) and energy (Atwater Factor).

RESULTS

Table 2 shows the result of the proximate composition of the wheat-cassava-cocoyam composite rock cake samples. Table 3 gives the percentage acceptance of the sensory qualities of the rock cake samples.

DISCUSSION

From Table 1 it can be seen that the moisture content of the samples studied in this work ranged from 21.6-22.6%. Different food materials have different capacity for absorbing/retaining moisture which may exist as occluded or absorbed water. As a result, it can be deduced that some moisture will be found in the samples as observed during the study (Eddy *et al.*, 2007; Eddy, 2004; James, 1984). The slight increase in the moisture content could be due to the high moisture content of both cassava and cocoyam.

The protein content of the composite rock cake samples were 7.4, 8.0, 6.9 and 6.5% for samples A, C, D and E respectively. The protein content decreased as the amount of the cassava and cocoyam flour increased. Generally, the protein content of all samples were relatively low because, wheat, cassava and cocoyam are poor sources of protein (Oyenuga, 1992; Okaka and Isieh, 2002).

Generally, the fat content of the rock cake samples studied in this work increased in the order of supplementation.

Table 2: Proximate analysis of cassava and cocoyam flour supplemented rock cake samples

		Sample						
Parameter	Method	A	B	C	D	E	F	G
Moisture (%)	AOAC (1990)	21.6	-	20.2	22.4	22.6	-	-
Ash (%)	AOAC (2000)	1.4	-	1.0	1.9	2.0	-	-
Fat (%)	AOAC (2000)	14.2	-	20.8	22.8	23.0	-	-
Protein (%)	AOAC (1990)	7.4	-	8.0	6.9	6.5	-	-
Carbohydrate (%)	By difference	45.7	-	46.0	50.0	55.4	-	-
Energy (kcal/100 g)	Atwater factor	422.3	-	416.8	400.8	379	-	-

Table 3: Percentage score on comparative sensory evaluation of cassava and coconut flour supplemented rock cake

	Organoleptic parameter						
Sample	Colour	Taste	Texture	Appearance	Aroma	Flavour	Overall acceptance
A	93.3	100	93.3	93.3	100	100	100
B	93.3	86.7	93.4	80.0	93.3	93.3	93.3
C	86.7	80.0	86.7	86.7	93.3	96.7	93.3
D	63.3	80.0	73.4	73.3	80.0	86.7	100
E	33.3	53.3	46.7	30.0	60.0	56.7	63.0
F	26.7	26.7	50.0	26.7	33.3	40.0	53.3
G	20.0	33.4	56.3	20.0	33.3	33.3	46.7

This could be due to the presence of the cocoyam flour since cassava has been found to reduce the fat content of rock cake (Eddy *et al*., 2007).

The ash content is also found to increase as the compositions of cassava flour and cocoyam flour increased. Generally the ash content of composite rock cakes increases as the level of supplementation increases implying that the inorganic nutrients in the composite rock cake is richer than that of wheat rock cake.

The carbohydrate of the rock cake samples ranged from 45.7-55.4% with higher values obtained in composite flour rock cake compared to the 100% wheat rock cake. This observation may be attributed to the high content of carbohydrate in cassava and cocoyam. According to Enwere (1998), of all the solid nutrients in roots and tubers, carbohydrate predominates. Carbohydrate supplies quick source of metabolizable energy and assists in fat metabolism.

Table 3 shows the percentage score on comparative sensory valuation of the rock cake samples studied in this work. The panelists accept the colour of the rock cake samples A and B equally (93.3%). The acceptance of the colour is found to decrease with increasing amount of cassava flour and cocoyam flour.

The acceptance of the taste of the rock cake samples A, B, C and D were found to be 100, 86.7, 80 and 80% respectively. It indicated that even though the panelists seem to prefer the whole wheat rock cake, they found the taste of supplemented rock cake samples up to 70% wheat flour to be quite good.

The texture of the whole wheat rock cake and the 90% wheat rock cake was accepted by 93.3% of the panelists. The 80% wheat rock cake was accepted by 86.7% while the 70% wheat rock cake was accepted by 73.4%. The texture, like the taste, was found to decrease with increasing amount of cassava and cocoyam flour.

93.7% of the panelists preferred the appearance of the whole wheat rock cake to the other rock cake samples. 80, 86.7 and 73.3% preferred the appearance of samples B, C and D respectively.

The aroma of the 100% wheat flour was preferred by 100% of the panelists and 93.3% of the panelists accepted the 90% and 80% wheat flour samples. 80% of the panelists preferred the 70% wheat flour sample. The acceptance of the flavour follows a similar pattern.

It is observed from Table 3 that the 100, 93.3, 93.3 and 100% of the panelists accept the rock cake samples A, B, C and D respectively. The mean of the overall acceptance ranged from 3.43±0.680 to 4.712±0.221, with the highest mean for sample A and the lowest for sample G. The differences in the means of samples A, B, C and D are significantly indifferent ($p<0.05$). Thus generally, the addition of cassava and cocoyam up to 30% level is acceptable to consumers just as the whole wheat rock cake.

Conclusion: The proximate analysis of the cassava and cocoyam supplemented wheat rock cake shows that the protein content of the rock cake decreased slightly with increasing amount of cassava and cocoyam flour. The organoleptic analysis also indicates that generally, whole rock cake and cassava-cocoyam-supplemented rock cake with cassava-cocoyam up to 30% is preferred to rock cake with cassava-cocoyam flour beyond 30%. Thus substitution of wheat flour with cassava-cocoyam flour up to 30% could help produce rock cake which could be accepted and also affordable to many Ghanaians.

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REFERENCES

AOAC, 1990. Methods of Association of Official Chemists. Official Methods of Analysis, 15th Edn., Virginia Assoc. Official Analytical Chemist, USA., pp: 1141.

AOAC, 2000. 920.03 Official Methods of the Association of Official Chemists. Official Analytical Int, Arlington VA.

Ceserani, V. and R. Kinton, 2008. Practical Cookery. 10th Edn., John Wiley and Sons, New York.

Dotsey, P., 2009. The use of cocoyam, cassava and wheat flour composite in the production of rock cakes, HND Dissertation, Cape Coast Polytechnic, Cape Coast, Ghana, 1: 7-40.

Eddy, N.O., 2004. Effect of processing on the chemical composition of some Nigerian food crops, M.Sc. Theses, University of Uyo, Uyo, Nigeria.

Eddy, N.O., P.G. Udofia and D. Eyo, 2007. Sensory evaluation of wheat/cassava composite rock cake and effect of label information on acceptance and preference. Afr. J. Biotechnol., 6: 2415-2418.

Enwere, N.J., 1998. Foods of plant origin. Afro-Orbis publication ltd., pp: 194-1999.

Food info.net., 2010. Tropical Roots and tubers: Cocoyam. Wageningen University, The Netherlands.

Ihekoronye, A.I. and P.O. Ngoddy, 1985. Integrated food science and technol, for the tropics. 1st Edn., McMillan Publishers, pp: 261, 265, 291.

James, E.G., 1984. Analytical chemistry of foods, Blackie Academic and Professional, London.

Kent, N.L. and A.D. Evers, 1994. Kent's Technology of Cereals, 4th Edn., Pergamon press, New York.

Ojinaka, M.C., E.N.T. Akobundu and M.O. Iwe, 2009. Cocoyam starch modification effects on functional, sensory and cookies qualities. Pak. J. Nutr., 8: 558-567.

Okaka, J.C. and M.I. Isieh, 2002. Development and quantity evaluation of cowpea wheat biscuits. Nig. Food J., 8: 56-62.

Opara, L.U., 2002. Edible Aroids: Postharvest Operation in: AGST/FAO: Danilo, M. (Ed.). Massey University, New Zealand.

Oyenuga, V.A., 1992. Nigerian Food and Feeding Stuffs, Ibadan, Ibadan University Press.

UNICEF, 19991. Cassava in Tropical Africa: A reference Manual; International Institute of Tropical Agriculture, Ibadan.

Watts, B.M., G.L. Ylimaki, L.E. Jeffrey and L.G. Ekics,1989. Basic sensory methods for food evaluation. International Development Research centre, Ottawa, Ontario, Canada, pp: 68-79.